THE PERCY SLADEN EXPEDITION IN H.M.S. SEALARK. THE CHAGOS ARCHIPELAGO.

OUR arrival in Mauritius on August 5 completed the first half of our cruise in H.M.S. *Sealark*, together with all our work directly connected with the Chagos Archipelago. This work may be divided under two heads, oceanography and biology. The former has been carried out mainly by Commander Boyle Somerville and his officers in view of the scientific objects of the expedition, but at the same time it is all of practical value for navigation in these waters. In many respects it has been of a singularly arduous nature; surveys by camping parties and deep soundings from the ship have been carried on simultaneously, together with numerous observations on the tides, currents, sea temperatures, &c. To a considerable degree it and all the work has been hampered by the heavy weather, which, contrary to all expectation, we have experienced, winds from south to east with heavy, confused seas, partially induced by the comparatively shallow waters of the Chagos Archipelago, and partially due to the current, which set in an easterly direction (against the wind) during the whole time we were in the group.

It is almost too soon to attempt to summarise any of the results of the cruise, but the soundings taken on our course from Ceylon to the Chagos and from the latter to Mauritius show that the archipelago is closely surrounded, both to the north and west, by the 2000-fathom line, and that there is at the present day no trace in the topography of the Indian Ocean of any former connection of the group with either the Maldives or the banks on the Seychelles-Mauritius line. The Chagos Archipelago appears, indeed, to stand by itself, being built up on a plateau rising to a depth of 800 fathoms in an ocean of an average depth of 2300 fathoms. Previously there were no bottom soundings between the banks and shoals of the group, but now a large series (more than 100) have been run, showing depths of 400 fathoms to 800 fathoms between the individual banks; from most of these a sample of the bottom has been obtained.

Broadly speaking, the Chagos group may be said to consist of three atolls to the north (Salomon, Peros Banhos, and Blenheim), the Great Chagos Bank in the centre (60 miles by 90 miles), and to the south two atolls, Diego Garcia and Egmont, besides certain submerged banks both to the north and south. Of these, H.M.S. *Sealark* has re-charted Salomon and parts of Peros Banhos, while Cooper and I have in addition examined the southern atolls. Salomon was very carefully surveyed, our intention being to make a comparison between its condition at the present time and when Powell's chart was made in 1837. The latter chart, however, proved to have been so carelessly drawn that any close comparison is, I fear, useless, but the new chart should be of great value when it is possible to re-examine the atoll at some future date. Its section lines show that it arises in the last 400 fathoms by similar slopes to those of Funafuti, but it is a much simpler atoll, having only one passage, and more than half its reef crowned by land. Our numerous soundings and dredgings on its slopes leave no room for doubt but that its present reef is extending outwards on every side on its own talus, in fact, that the steep found round it (and, indeed, most atolls) is, *in this instance*, simply the slope at which coral and other remains from the reef above come to rest in the water. Its face was everywhere singularly barren; Lithothamnion, Polytrema, and, of course, reef-corals were not obtained below 50 fathoms. Further out, at 250 fathoms and over, the bottom was smooth and barren; the lead constantly failed to bring up any samples, while the somewhat broken and dented, but almost empty, dredges gave the idea of bare rock with a little muddy sand here and there. Indeed, our evidence points to the impossibility of any upward growth being in progress between the different Chagos banks, and to the probability of considerable current being felt even at 500 fathoms.

The reefs of the Chagos are in no way peculiar save in their extraordinary paucity of animal life, to which I referred in my last letter. Green weed, too, of every sort is practically absent. However, this barrenness is amply compensated for by the enormous quantity of nullipores (Lithothamnia, &c.), incrusting, massive, mammillated, columnar, and branching. The outgrowing seaward edges of the reefs are practically formed by their growths, and it is not too much to say that were it not for the abundance and large masses of these organisms there would be no atolls with surface reefs, &c., in the Chagos. The lagoon shoals of Egmont are covered by them, and alone reach the surface; having once done so they die and become hollowed out in the centre, finally resembling miniature atolls.

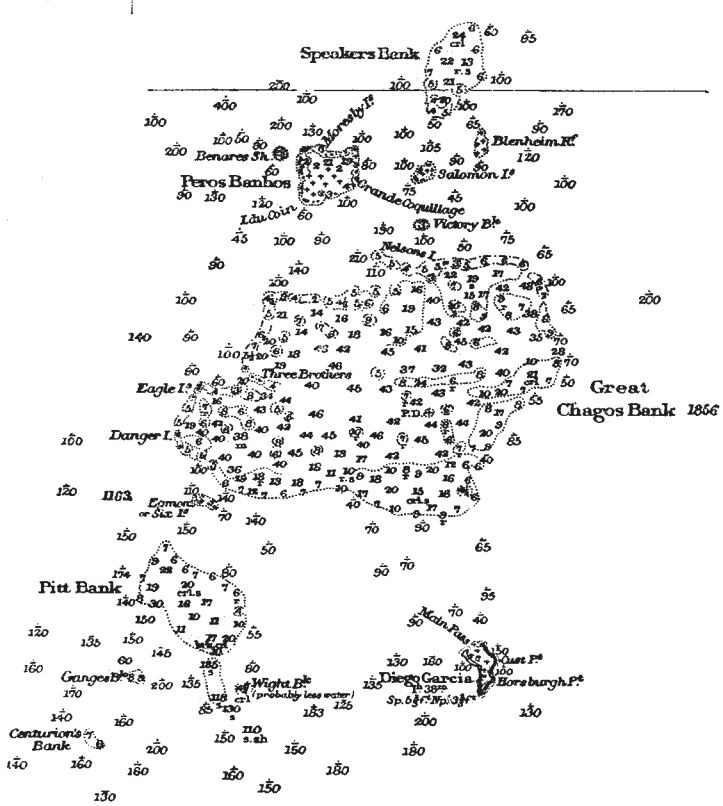

FIG. 1.—Chart of the Chagos Archipelago.

In such a large group the conditions of the encircling reefs against the lagoons naturally vary very considerably. In general their inner edges reach the surface, and in the more open atolls the lagoon slope to 10 fathoms closely resembles the seaward slope. The bottoms of the lagoons are bare, rock, hard sand or mud, with shoals arising precipitously here and there, built up by a few species of coral, but largely covered by Xenia and Sarcophytum (as also are the only two submerged banks, Wight and Centurion, which we examined). Diego Garcia lagoon differs somewhat owing to its being almost completely surrounded by land. It has perhaps the most varied fauna in the group, and alone gives definite evidence of enlarging in every direction. Everywhere the land is entirely of coral origin. Diego Garcia shows signs of a recent elevation of a few feet, the present single island having been formed by the joining up of a series of separate islets on an elongated reef. The kuli or barachois (large shallow lakes) of the same island owe their origin to the same elevation, though elsewhere in the group they are generally due to

the successive washing up of beaches from the sea, enclosing areas of the reef. On the whole, there is singularly little change since the survey in 1837, and my impression is that Chagos has been for a long time an area of rest, and that the *present* condition of its reefs is mainly due to agencies still in action.

We have now examined the marine fauna in Salomon, Peros Banhos, Diego Garcia, and Egmont, and I would again lay stress on its comparative paucity and lack of variety as compared with the Maldives, Fiji, or even Funafuti, though many of the forms are very common. In short, its general character is rather that of the temperate than of the tropical zone.

The land fauna is largely dependent on the flora, and the latter, except on small isolated islets and selected positions, has been destroyed to allow of cocoanuts being planted. The shores are everywhere fringed with *Scaevola koenigii* and *Tournefortia argentea*, both covered with a climbing bean. Behind these there was originally a forest formed of immense mapon (*Pisonia capidia*) and takamaka (*Calophyllum inophyllum*), with a few cocoanuts, Barringtonia, banyans, and other smaller trees, and an undergrowth largely consisting of immense Asplenium and other

FIG. 2.—Lithothamnia on the Seaward Reef of Salomon Atoll, Chagos Archipelago

ferns and Psilotum, herbaceous dicotyledons being confined to the more open, dry, sandy, and stony parts; mangroves and Pandani are, curiously enough, not found. With the assistance of Dr. Simpson, we have collected the flora of each of the atolls, obtaining more than 600 specimens, about 140 species, of which probably only half are indigenous.

Of mammals there are only rats and mice, but there are traditions of dugong as well. Of birds the cardinal, sparrow, and mina have doubtless been introduced; noddies, frigates, and terns were breeding in enormous numbers on certain islands, though it was mid-winter; crab-plover, curlew, whimbal, and a sandpiper were common, and in the north-west monsoon buzzards, kites, and crows are said to be regular visitants. The green and shell turtles (*Chelone mydas* and *C. imbricata*) abound, the former coming on shore to deposit its eggs at night and the latter in the daytime. The only other reptiles are a marsh tortoise, perhaps introduced from Madagascar, and geckoes; there are no Amphibia. There is only one land shell, and arachnids and myriapods are scanty; the land crustacea are similar to those of the Maldives, but the coco crab (*Birgus latio*) is also abundant. Mr. Bainbrigge Fletcher has sorted the insects and finds about 110 species, most of which are probably indigenous; but the best season for the group would be in the rather hotter and damper north-west monsoon. On the whole, the land fauna and flora is much what one would expect to get, regarding the Chagos as a group of purely oceanic islands.

We expect to leave Mauritius toward the end of August for Cargados, Agalegas, and the submerged banks towards the Seychelles. Our cruise will be largely a dredging one, but the examination of Agalegas should be interesting. Meanwhile, Cooper and I hope to see some of the reefs round Mauritius.

J. STANLEY GARDINER.

IRON AND STEEL INSTITUTE.

FOR the first time the autumn meeting of the Iron and Steel Institute was this year held in Sheffield. An elaborate programme of visits to works and social functions was arranged, and no less than 1500 members and ladies were present, including members from all parts of the world. The opening meeting was held at the new university on September 26 under the presidency of Mr. R. A. Hadfield. Addresses of welcome were delivered by the Lord Mayor, the Master Cutler, the Vice-Chancellor of the University, Colonel Hughes (chairman of the reception committee), and by the president of the Sheffield Trades and Labour Council on behalf of the working men. Mr. Hadfield, in reply, thanked the reception committee for the admirable work it had done, and gave an interesting historical review of the Sheffield steel trade. Incidentally, he mentioned that the membership of the Iron and Steel Institute had now risen to 2200. After the reading of the minutes of the last meeting by the secretary, Mr. Bennett H. Brough, and the transaction of other routine business, the papers submitted were read and discussed. In the first paper taken Prof. J. O. Arnold described the department of iron and steel metallurgy at the University of Sheffield. The main object borne in mind in designing the laboratory was the erection on a manufacturing scale of plant producing steel by the crucible, Bessemer, and Siemens processes.

Prof. J. O. Arnold and Mr. A. McWilliam next contributed an important paper on the thermal transformations of carbon steels. For the research three steels were selected, saturated with 0.89 per cent. of carbon, unsaturated with 0.21 per cent. of carbon, and supersaturated with 1.78 per cent. of carbon. In the case of the unsaturated steel, the authors find that above Ar 3 (810° C.) the ferrite and hardenite are in mutual solution as a homogeneous mass. The Ar 3 change is accompanied by a segregation of the two constituents, which, if the cooling be slow, is probably completed in the Beta range of temperature. After a fairly rapid cooling from 950° C. the 0.21 per cent. carbon steel when quenched at 730° C. micrographically registered a segregation of ferrite so far advanced as strongly to suggest that such segregation must have begun at Ar 3 and not at Ar 2. In other words, hardenite is insoluble in ferrite in both the Beta and Alpha ranges of temperature. It however still retains its identity as hardenite whilst falling through, say, 30° C. or 40° C. of temperature in the Alpha range, namely, from the end of Ar 2 at about 720° C. to the beginning of Ar 1 at about 680° C., at which latter temperature it begins to decompose into pearlite. The heating transformations of this steel are substantially as follows:—At Ac 1 (about 710° C.) in the Alpha range the pearlite begins to change into hardenite, hence the carbide is soluble in the